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(54) Gas turbine engine combustor

Gasturbinenbrennkammer

Chambre de combustion pour une turbine à gaz

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(73) Proprietor: **ROLLS-ROYCE plc**
London, SW1E 6AT (GB)

(72) Inventor: **Allen, John Guy**
Chipping Sodbury, Bristol BS17 6NS (GB)

(74) Representative: **Chapman, Helga Claire**
Rolls-Royce plc
Patents Department
Moor Lane
P.O. Box 31
Derby DE24 8BJ (GB)

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Description

[0001] This invention relates to a gas turbine engine combustor and is particularly concerned with the thermal protection of the combustor wall or bulkhead by heatshields and specifically the miniflare associated therewith.

[0002] Modern gas turbine annular combustors are usually provided with a combustor which is of generally annular configuration. Usually a wall or bulkhead is provided at the upstream end of the combustor which is suitably apertured to receive a number of fuel burners. The fuel burners are equally spaced around the combustor and direct fuel into the combustor to support combustion therein. The combustor bulkhead is therefore usually close to the high temperature combustion process taking place within the combustor making it vulnerable to heat damage.

[0003] One way of protecting the bulkhead from the direct effects of the combustion process is to position heat shields on its vulnerable parts. Typically each heat shield is associated with a corresponding fuel burner and extends both radially towards the radially inner and outer extents of the bulkhead and circumferentially to abut adjacent heat shields. Each heat shield is spaced apart from the bulkhead so that a narrow space is defined between them. Cooling air is directed into this space in order to provide cooling of the heat shield and so maintain the heat shield and the bulkhead at acceptably low temperatures.

[0004] More recently cylinders comprising end flanges, commonly known as miniflares, have been used to direct a film of cooling air across the heatshield thus protecting it from hot combustion gases. <u>US4,914,918 discloses one such prior art miniflare, however, although this</u> miniflare provide a film of cooling air for the heat shield their own cooling is insufficient to prevent overheating, in particular towards its outer edge. Additionally the cooling film produced often ceases to be effective at the outer regions of the heatshield. It is an aim of the present invention, therefore, to provide an improved device for cooling a heatshield which attempts to alleviate the aforementioned problems.

[0005] According to the present invention there is provided a combustor for a gas turbine engine in which a fuel nozzle is located in the upstream end thereof and is positioned within a hollow, annular cylinder, said cylinder comprising at its downstream end an annular flange extending from said cylinder in a generally radial direction and said flange comprising a plurality of apertures extending therethrough.

[0006] Advantageously cooling air is directed through 'the apertures in the annular flange thus increasing the outer edge of the cylinder and also provides an effective cooling air film across an adjacent heatshield.

[0007] The present invention will now be described, by way of example, with reference to the accompanying drawings in which:

Figure 1 is a schematic diagram of a ducted fan gas turbine engine having an annular combustor.

Figure 2 is a partially sectioned side view of a combustor in accordance with the present invention.

Figure 3 is view of a cylinder and flange in accordance with the present invention.

Figure 4 is a cross sectional view of a portion of the cylinder and flange (apertures not shown) of figure 3.

[0008] With reference to figure 1 there is shown a three shafted ducted fan gas turbine engine of generally conventional configuration. It will be understood however that the present invention may be usefully employed in other engine configurations.

[0009] The engine of figure 1 comprises in axial flow series a low pressure spool consisting of a fan 2 driven by a low pressure turbine 4 via a first shaft 6, an intermediate pressure turbine 10 through a second shaft 12 and a high pressure compressor 14 driven by a high pressure turbine 16 via a third shaft 18, an annular combustor 20 and a propulsive nozzle 21.

[0010] The annular combustor 20 is shown in more detail in Figure 2. The combustor chamber inner casing 22 comprises radially spaced inner and outer walls 24, 26 respectively, interconnected at their upstream ends by means of an annular bulkhead 28. The walls 24 and 26 extend upstream of the bulkhead to form a domed combustor head 30. The bulkhead divides the combustor into an upstream cooling air chamber 32 and a downstream combustion region and a downstream combustion region 34.

[0011] Compressor delivery air from an upstream compressor (not shown, but situated to the left of the drawing) enters the cooling air chamber 32 through a plurality of circumferentially spaced inlet apertures 36 before entering the combustion chamber 34. Fuel is delivered to the combustion chamber by means of a plurality of air spray type fuel supply nozzles 38. The nozzles are suspended from a combustion chamber outer casing structure 40 and extend into the combustor 20 through a corresponding array of circumferentially spaced apertures 42 is provided in the bulkhead member 28, each to receiver the outlet of an adjacent one of the nozzles.

[0012] A protective heatshield 44 is mounted on the downstream face of the bulkhead 28 to provide thermal shielding from combustion temperatures. This heatshield has an annular configuration made up of a plurality of abutting heatshield segments 46. The segments, which are of substantially identical form, extend both radially towards the inner and outer walls 24, 26 of the combustor and circumferentially towards adjacent segments to define a fully annular shield. Some or all of the heatshield segments may be adapted to receive a fuel nozzle. Those which receive a fuel nozzle comprise an aperture the periphery of which is defined by an axially extending cylindrical flange 48 which locates the heat-

shield in the corresponding aperture 42 in the bulkhead wall 28.

[0013] Each heatshield segment receives an airspray burner and a miniflare seal 49. The miniflare seal 49 is in the form of an annular cylinder 50 and is provided with a pair of axially spaced radial flanges 52 and 54 which slidably engage with the heatshield flange extremities. The cylindrical miniflare 49 has an external diameter which is less than the heatshield aperture. The miniflare radial flange 54 extends radially from the downstream end of the cylinder. This flange 54 comprises a further axially extending end flange portion 56. This axially extending flange portion comprises two rows of holes 58, 60 axially spaced from one another. The upstream outer rim of this end flange portion 56 is provided with castellations 62 at its outer edge.

[0014] In use air passes through slots 64 defined in the heat shield flange 48 between the miniflare 49 and the heatshield 44 into a chamber. The air then discharges through the two rows 58 and 60 of holes to,produce a cooling film across the heatshield 44 or head of the chamber. Also air passing through the holes will remove heat from the edge of the miniflare 49. The provision of multi rows of holes 58, 60 in the miniflare flange end portion 56 increases the cooling of the outer edge of the miniflare and as such reduces its surface temperature and provides a more effective air film across the heatshield 44 or combustor head face thus increasing the protection from hot combustion gases.

Claims

1. A combustor (20) for a gas turbine engine in which a fuel nozzle (38) is located in the upstream end thereof and is positioned within an annular cylinder (50) coaxial with the fuel nozzle (38), the annular cylinder (50) comprising at its downstream end an annular flange (54) extending from the annular cylinder (50) in a generally radial direction, the annular flange (50) further comprises a flange portion (56), the flange portion (56) defines a plurality of castellations (62) in the an upstream edge thereof, **characterised in that** said flange portion (56) extends axially and defines a plurality of cooling fluid apertures (58) that radially extend therethrough.

2. A combustor (20) according to claim 1 **characterised in that** the annular cylinder (50) is of unitary construction.

3. A combustor (20) according to any one of claims 1-2 **characterised in that** the flange portion (56) extends axially in the upstream direction

4. A combustor (20) according to any one of the preceding claims **characterised in that** the apertures (58, 60) are provided in two axially spaced rows (58, 60) within the flange portion (56).

5. A combustor (20) according to any one of the preceding claims **characterised in that** said annular cylinder (50) also comprises a second flange (52) positioned axially upstream from said flange (54) of claim 1.

6. A combustor (20) according to any one of the preceding claims **characterised in that** a heatshield (44) is provided within an aperture for receiving said fuel nozzle (38).

7. A combustor (20) according to claim 6 **characterised in that** said heatshield (44) aperture comprises an axially extending cylindrical flange (48) which locates the heatshield (44) in a corresponding aperture in the bulkhead (28) of the combustor (20).

8. A combustor (20) according to claim 7 **characterised in that** the heatshield flange (48) is provided with slots (64) to direct cooling fluid to an annular region (66) between the heatshield flange (48) and the cylinder (50).

9. A combustor (20) according to any one of the preceding claims **characterised in that** said cooling air is directed radially by said cylinder (50) and associated flange (54) as a film of air across the heatshield (44).

Patentansprüche

1. Brennkammer (20) für ein Gasturbinentriebwerk mit einer Brennstoffdüse (38) im stromaufwärtigen Ende, die innerhalb eines Ringzylinders (50) koaxial zur Brennstoffdüse (38) liegt, wobei der Ringzylinder (50) an seinem stromabwärtigen Ende einen Ringflansch (54) aufweist, der sich von dem Ringzylinder (50) in einer allgemein radialen Richtung erstreckt und der Ringflansch (54) weiter einen Flansch (56) aufweist, der mehrere Verzahnungen (62) am stromaufwärtigen Rand aufweist, **dadurch gekennzeichnet, daß** der Flansch (56) sich axial erstreckt und mehrere Kühlfluidöffnungen (58) aufweist, die sich in Radialrichtung durch den Flansch hindurch erstrecken.

2. Brennkammer (20) nach Anspruch 1,
dadurch gekennzeichnet, daß der Ringzylinder (50) eine einheitliche Konstruktion aufweist.

3. Brennkammer (20) nach einem der Ansprüche 1 oder 2,
dadurch gekennzeichnet, daß der Flansch (56) sich axial stromauf erstreckt.

4. Brennkammer (20) nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, daß** die Öffnungen (58, 60) in zwei axial im Abstand zueinander angeordneten Reihen (58, 60) innerhalb des Flansches (56) liegen.

5. Brennkammer (20) nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, daß** der Ringzylinder (50) außerdem einen zweiten Flansch (52) aufweist, der axial stromauf des Flansches (54) gemäß Fig. 1 angeordnet ist.

6. Brennkammer (20) nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, daß** ein Hitzeschild (44) innerhalb einer Öffnung vorgesehen ist, um die Brennstoffdüse (38) aufzunehmen.

7. Brennkammer (20) nach Anspruch 6, **dadurch gekennzeichnet, daß** die Öffnung des Hitzeschildes (44) einen axial verlaufenden zylindrischen Flansch (48) aufweist, der den Hitzeschild (44) in einer entsprechenden Öffnung im Brennerkopf (28) der Brennkammer (20) festlegt.

8. Brennkammer (20) nach Anspruch 7, **dadurch gekennzeichnet, daß** der Flansch (48) des Hitzeschildes mit Schlitzen (64) versehen ist, um Kühlluft auf einen Ringbereich (66) zwischen dem Hitzeschildflansch (48) und dem Zylinder (50) zu richten.

9. Brennkammer (20) nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, daß** die Kühlluft durch den Zylinder (50) und den zugeordneten Flansch (54) radial als Luftfilm über den Hitzeschild (44) gerichtet wird.

Revendications

1. Chambre de combustion (20) pour un moteur à turbine à gaz dans lequel une buse de combustible (38) est située dans l'extrémité amont de la chambre et est positionnée à l'intérieur d'un cylindre annulaire (50) qui s'étend coaxialement à la buse de combustible (38), le cylindre annulaire (50) comprenant au niveau de son extrémité aval une bride annulaire (54) s'étendant à partir du cylindre annulaire (50) dans une direction généralement radiale, la bride annulaire (50) comprenant en outre une partie de bride (56), la partie de bride (56) définissant plusieurs crénelures (62) dans un bord amont de celle-ci, **caractérisé en ce que** ladite partie de bride (56) s'étend axialement et définit plusieurs ouvertures de refroidissement de fluide (58) qui s'étendent radialement à travers.

2. Chambre de combustion (20) selon la revendication 1, **caractérisée en ce que** le cylindre annulaire (50) est monobloc.

3. Chambre de combustion (20) selon l'une quelconque des revendications 1 et 2, **caractérisée en ce que** la partie de bride (56) s'étend axialement dans la direction amont.

4. Chambre de combustion (20) selon l'une quelconque des revendications précédentes, **caractérisée en ce que** les ouvertures (58, 60) sont prévues en deux rangées espacées axialement (58, 60) à l'intérieur de la partie de bride (56).

5. Chambre de combustion (20) selon l'une quelconque des revendications précédentes, **caractérisée en ce que** ledit cylindre annulaire (50) comprend également une seconde bride (52) positionnée axialement en amont de ladite bride (54) de la revendication 1.

6. Chambre de combustion (20) selon l'une quelconque des revendications précédentes, **caractérisée en ce qu'**un écran thermique (44) est prévu à l'intérieur d'une ouverture pour recevoir ladite buse de combustible (38).

7. Chambre de combustion (20) selon la revendication 6, **caractérisée en ce que** ladite ouverture à écran thermique (44) comprend une bride cylindrique (48) qui s'étend axialement et qui positionne l'écran thermique (44) dans une ouverture correspondante dans le cadre (28) de la chambre de combustion (20).

8. Chambre de combustion (20) selon la revendication 7, **caractérisée en ce que** la bride à écran thermique (48) est pourvue de fentes (64) pour diriger un fluide de refroidissement vers une région annulaire (66) située entre la bride à écran thermique (48) et le cylindre (50).

9. Chambre de combustion (20) selon l'une quelconque des revendications précédentes, **caractérisée en ce que** ledit air de refroidissement est dirigé radialement par ledit cylindre (50) et la bride associée (54) sous la forme d'un film d'air à travers l'écran thermique (44).

Fig.1.

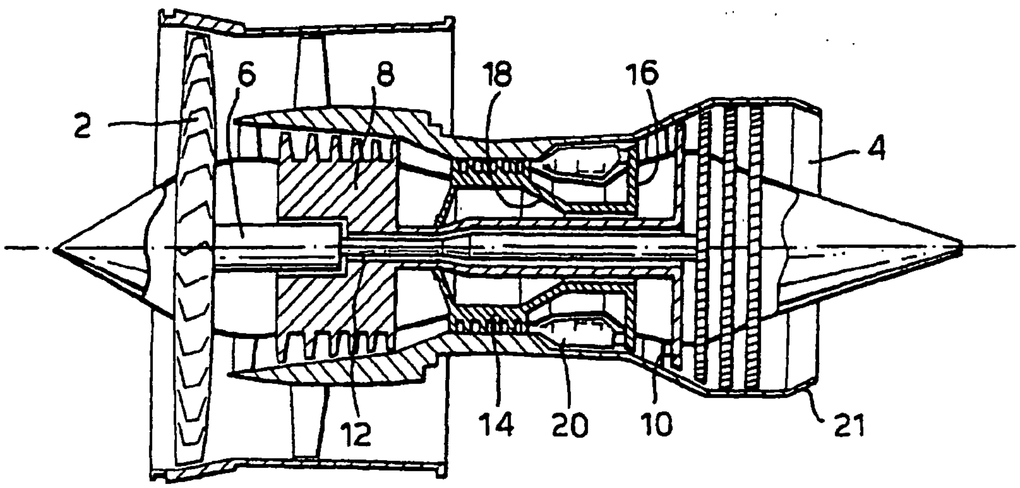


Fig.3.

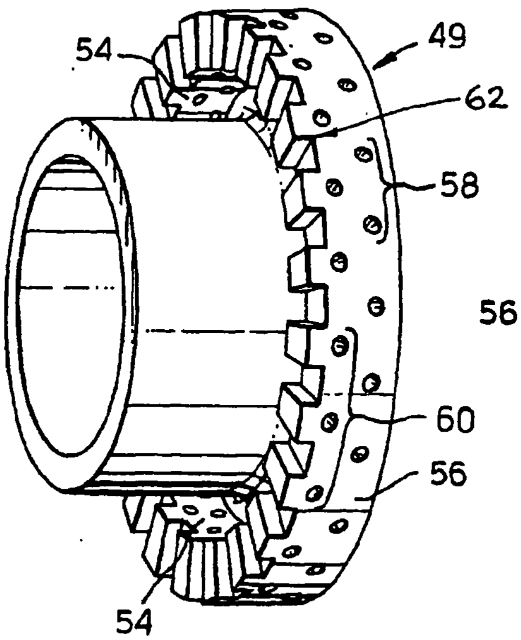


Fig.4.

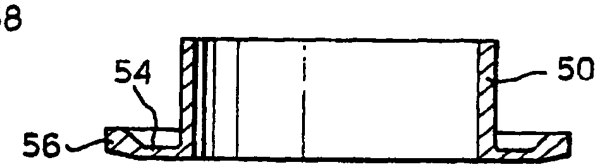
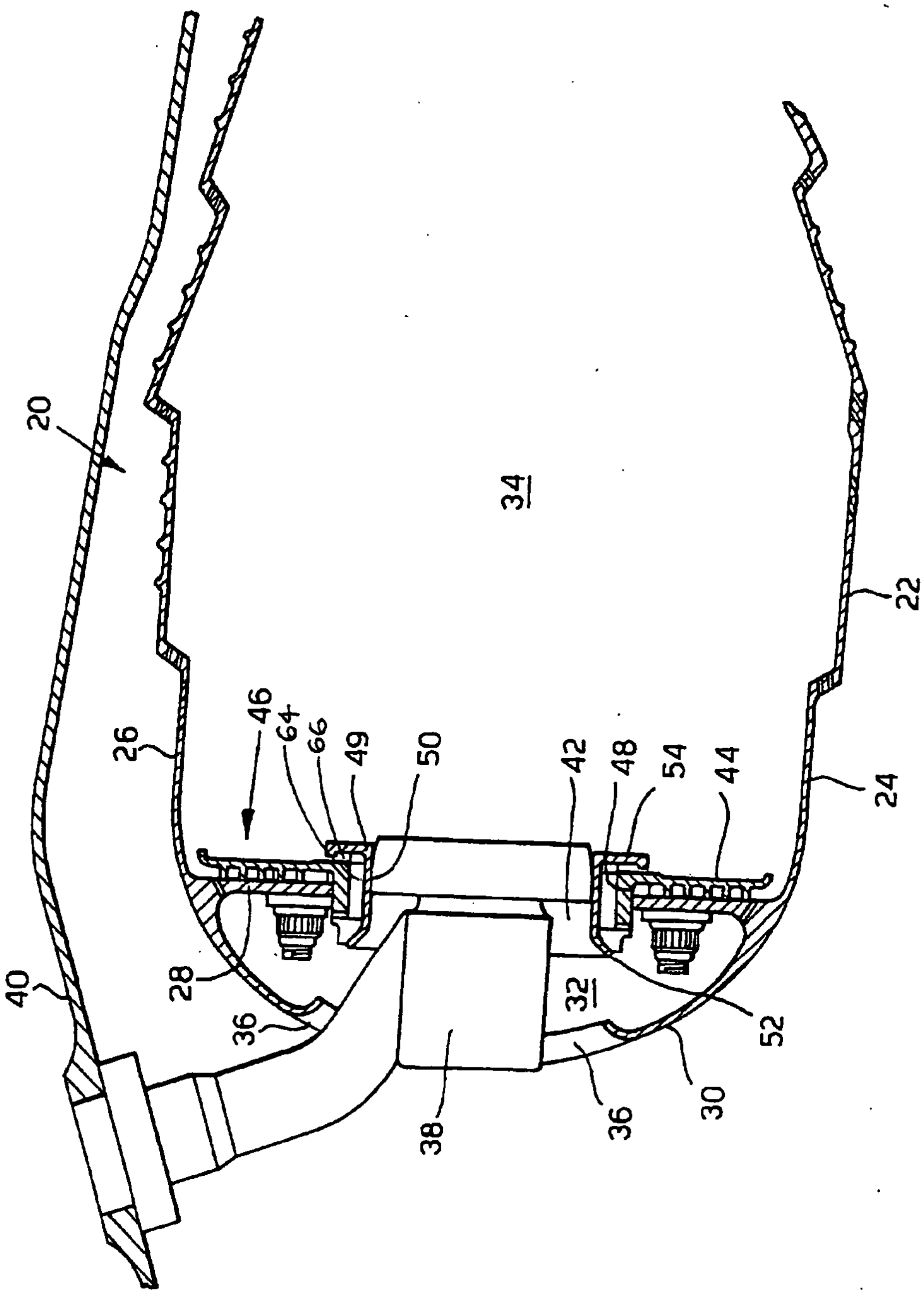


Fig.2.



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(71) Applicant: **ROLLS-ROYCE plc**
London, SW1E 6AT (GB)

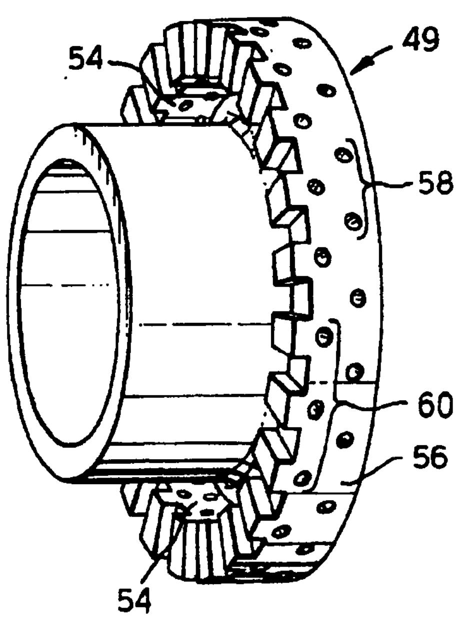
(72) Inventor: **Allen, John Guy**
Chipping Sodbury, Bristol BS17 6NS (GB)

(74) Representative: **Chapman, Helga Claire**
Rolls-Royce plc
Patents Department
Moor Lane
P.O. Box 31
Derby DE24 8BJ (GB)

(54) **Gas turbine engine combustor**

(57) A combustor for a gas turbine engine has a fuel nozzle located in the upstream end thereof and is positioned within a cylinder coaxial with said nozzle. The cylinder comprises at its downstream end an annular flange extending from the cylinder in a generally radial direction. The flange has a plurality of cooling air apertures radially extending therethrough so as to direct cooling air along the face of an adjacent heatshield.

Fig.3.



EP 0 841 520 A3

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EUROPEAN SEARCH REPORT

Application Number
EP 97 30 8248

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X	DE 44 27 222 A (BMW ROLLS ROYCE GMBH) 8 February 1996 (1996-02-08) * figures *	1-9	
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TECHNICAL FIELDS SEARCHED (Int.Cl.6)

F23R

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	16 September 1999	Raspo, F

CATEGORY OF CITED DOCUMENTS

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